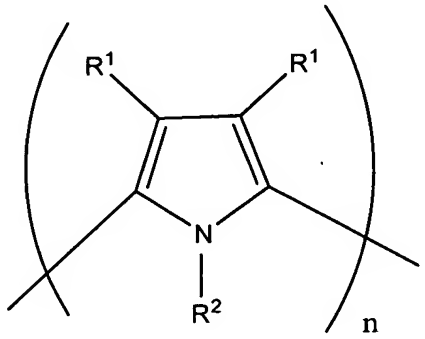
CLAIMS

What is claimed is:

1. A composition comprising an aqueous dispersion of a polypyrrole and at least one colloid-forming polymeric acid.

2. A composition according to Claim 1, wherein said polypyrrole has Formula I below.



(I)

where in Formula I:

R^1 is independently selected so as to be the same or different at each occurrence and is selected from hydrogen, alkyl, alkenyl, alkoxy, alkanoyl, alkythio, aryloxy, alkylthioalkyl, alkylaryl, arylalkyl, amino, alkylamino, dialkylamino, aryl, alkylsulfinyl, alkoxyalkyl, alkylsulfonyl, arylthio, arylsulfinyl, alkoxycarbonyl, arylsulfonyl, acrylic acid, phosphoric acid, phosphonic acid, halogen, nitro, cyano, hydroxyl, epoxy, silane, siloxane, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, and urethane; or both R^1 groups together may form an alkylene or alkenylene chain completing a 3, 4, 5, 6, or 7-membered aromatic or alicyclic ring, which ring may optionally include one or more divalent nitrogen, sulfur or oxygen atoms; and

R^2 is independently selected so as to be the same or different at each occurrence and is selected from hydrogen, alkyl, alkenyl, aryl, alkanoyl, alkylthioalkyl, alkylaryl, arylalkyl, amino, epoxy, silane, siloxane, amidosulfonate, alcohol, benzyl, carboxylate, ether, ether carboxylate, ether sulfonate, and urethane, and may be a homopolymer or co-polymer.

3. A composition according to Claim 2, wherein R^1 is the same or different at each occurrence and is independently selected from hydrogen,

alkyl, alkenyl, alkoxy, cycloalkyl, cycloalkenyl, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, urethane, epoxy, silane, siloxane, and alkyl substituted with one or more of sulfonic acid, carboxylic acid, acrylic acid, phosphoric acid, phosphonic acid, halogen, nitro, cyano, hydroxyl, epoxy, silane, or siloxane moieties.

4. A composition according to Claim 2, wherein R^2 is selected from hydrogen, alkyl, and alkyl substituted with one or more of sulfonic acid, carboxylic acid, acrylic acid, phosphoric acid, phosphonic acid, halogen, cyano, hydroxyl, epoxy, silane, or siloxane moieties.

5. A composition according to Claim 2, wherein R^1 and R^2 are hydrogen.

6. A composition according to Claim 2, wherein both R^1 together form a 6- or 7-membered alicyclic ring, which is further substituted with a group selected from alkyl, heteroalkyl, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, and urethane.

7. A composition according to Claim 2, wherein both R^1 together form $-O-(CHY)_m-O-$, where m is 2 or 3, and Y is the same or different at each occurrence and is selected from hydrogen, alkyl, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, and urethane.

8. A composition according to Claim 1, wherein said colloid-forming polymeric acid is selected from polymeric sulfonic acids, polymeric carboxylic acids, polymeric acrylic acids, polymeric phosphoric acids, polymeric phosphonic acids, and mixtures thereof.

9. A composition according to Claim 1, wherein said polymeric acid is a fluorinated polymeric sulfonic acid.

10. The composition of Claim 1, wherein the composition further comprises at least one selected from a conductive polymer, metal particles, graphite fibers, graphite particles, carbon nanotubes, carbon nanoparticles, metal nanowires, organic conductive inks, organic conductive pastes, inorganic conductive inks, inorganic conductive pastes, charge transport materials, semiconductive inorganic oxide nano-particles, insulating inorganic oxide nano-particles, piezoelectric oxide nano-particles, piezoelectric polymers, pyrroelectric oxide nano-particles, pyrroelectric polymers, ferroelectric oxide nano-particles, ferroelectric polymers, dispersing agents, crosslinking agents and combinations thereof.

11. The composition of claim 1, wherein the composition has a pH of 1 to 8

12. A composition according to Claim 9, wherein said polymeric sulfonic acid is a perfluoroalkylenesulfonic acid.

13. An electronic device comprising at least one layer comprising at least one polypyrrole and at least one colloid-forming polymeric acid.

14. The device of Claim 13, wherein the layer is made from the composition of claim 1 having a pH greater than 3.5.

15. The device according to Claim 13, wherein the layer comprises a colloid forming polymeric acid is selected from polymeric sulfonic acids, polymeric carboxylic acids, polymeric phosphoric acid, polymeric phosphonic acids, polymeric acrylic acids, and mixtures thereof.

16. An electronic device according to Claim 13, wherein the device is a photosensor, photoswitch, phototransistor, photoconductor, biosensor, phototube, IR detectors, photovoltaic device, photoconductive cell, photoresistor, solar cell, light-emitting diode, light-emitting diode display, diode, electrochromic display, electromagnetic shielding device, memory storage device, transistor, field effect resistance devices, solid electrolyte capacitors, rechargeable batteries, and diode laser.

17. A thin film field effect transistor comprising at least one electrode comprising a composition comprising at least one polypyrrole and at least one colloid-forming polymeric acid.

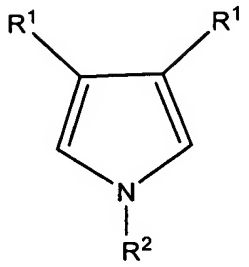
18. A thin film field effect transistor according to Claim 16, wherein said electrode further comprises metal nanowires, metal nanoparticles, or carbon nanotubes, or mixtures thereof.

19. Anti-static coating and anti-corrosion protection coating comprising at least one layer comprising at least one polypyrrole and at least one colloid-forming polymeric acid.

20. A method of making the composition of Claim 1, comprising forming a combination of water, at least one pyrrole monomer, at least one colloid-forming polymeric acid, and an oxidizing agent, in any order, provided that at least a portion of the colloid-forming polymeric acid is present when at least one of the pyrrole monomer and the oxidizing agent is added.

21. The method according to Claim 20, wherein the polymeric acid is selected from polymeric sulfonic acids, polymeric carboxylic acids, polymeric acrylic acids, polymeric phosphoric acid, polymeric phosphonic

acids, and mixtures thereof and the pyrrole monomers are selected from Formula II



(II)

wherein:

R^1 is independently selected so as to be the same or different at each occurrence and is selected from hydrogen, alkyl, alkenyl, alkoxy, alkanoyl, alkythio, aryloxy, alkylthioalkyl, alkylaryl, arylalkyl, amino, alkylamino, dialkylamino, aryl, alkylsulfinyl, alkoxyalkyl, alkylsulfonyl, arylthio, arylsulfinyl, alkoxycarbonyl, arylsulfonyl, acrylic acid, phosphoric acid, phosphonic acid, halogen, nitro, cyano, hydroxyl, epoxy, silane, siloxane, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, and urethane; or both R^1 groups together may form an alkylene or alkenylene chain completing a 3, 4, 5, 6, or 7-membered aromatic or alicyclic ring, which ring may optionally include one or more divalent nitrogen, sulfur or oxygen atoms; and

R^2 is independently selected so as to be the same or different at each occurrence and is selected from hydrogen, alkyl, alkenyl, aryl, alkanoyl, alkylthioalkyl, alkylaryl, arylalkyl, amino, epoxy, silane, siloxane, amidosulfonate, alcohol, benzyl, carboxylate, ether, ether carboxylate, amidosulfonate, ether sulfonate, and urethane.

22. The method of Claim 20, further comprising adding a material selected from a catalyst, a co-dispersing agent, a co-acid or mixtures thereof.

23. The method of Claim 20 and 22, wherein at least one pyrrole monomer is added using a controlled rate of addition to a reaction mixture.

24. The method of Claim 20 and 22, wherein the monomer is added to the reaction mixture separately and simultaneously with the controlled rate of addition of an oxidizing agent.

25. The method of claim 22, wherein co-dispersing agent is added in the reaction mixture or preferably at the end of polymerization.

26. The method according to claim 25, the dispersing agent is, but not limited to, methanol, n-propanol, iso-propanol, butanol, and the like.

27. The method of claim 20 and 22, wherein the aqueous dispersion of polypyrrole and colloid-forming polymeric acid is contacted with at least one ion exchange resin.

28. The method of claim 20 and 22, wherein the aqueous dispersion of polypyrrole and colloid-forming polymeric acid is contacted with at least one cation exchange resin and one anion exchange resin.

29. The method of claim 20 and 22, wherein the aqueous dispersion of polypyrrole and colloid-forming polymeric acid is contacted with at least one cation exchange resin and one anion exchange resin.

30. The method of claim 28 and 29, wherein the aqueous dispersion of polypyrrole and colloid-forming polymeric acid is further treated with an aqueous basic solution.

31. The method of Claim 30, further comprising adding at least one selected from a conductive polymer, metal particles, graphite fibers, graphite particles, carbon nanotubes, carbon nanoparticles, metal nanowires, organic conductive inks, organic conductive pastes, inorganic conductive inks, inorganic conductive pastes, charge transport materials, semiconductive inorganic oxide nano-particles, insulating inorganic oxide nano-particles, piezoelectric oxide nano-particles, piezoelectric polymers, pyrroelectric oxide nano-particles, pyrroelectric polymers, ferroelectric oxide nano-particles, ferroelectric polymers, dispersing agents, crosslinking agents and combinations thereof.